



**Groundbreaking  
Simulation Solutions**

*physics on screen*

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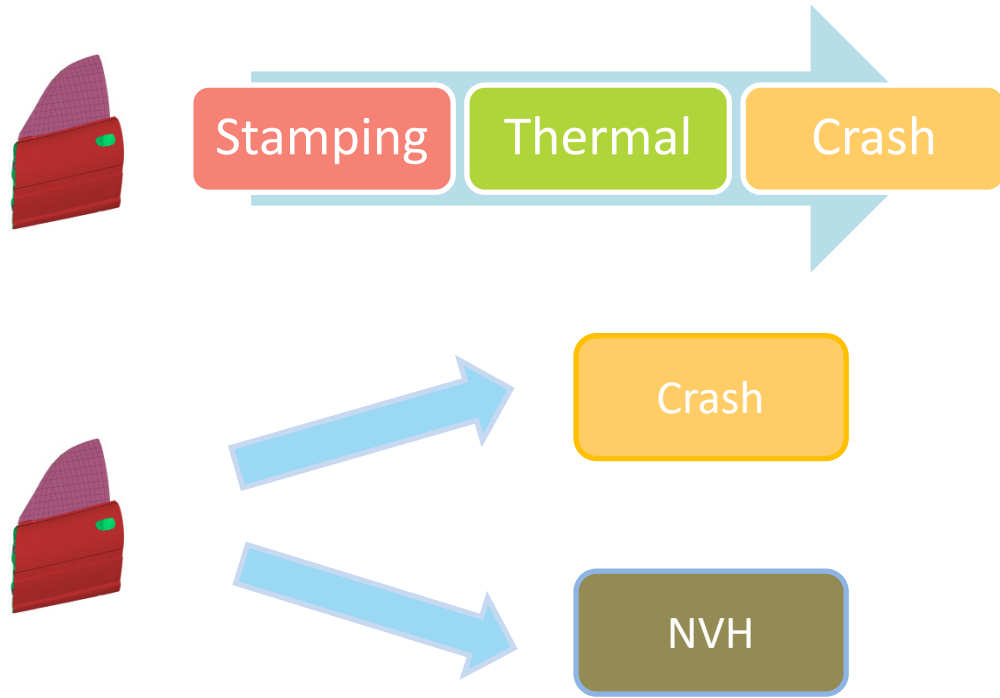


# Breaking down the interoperability barrier among different FEA software

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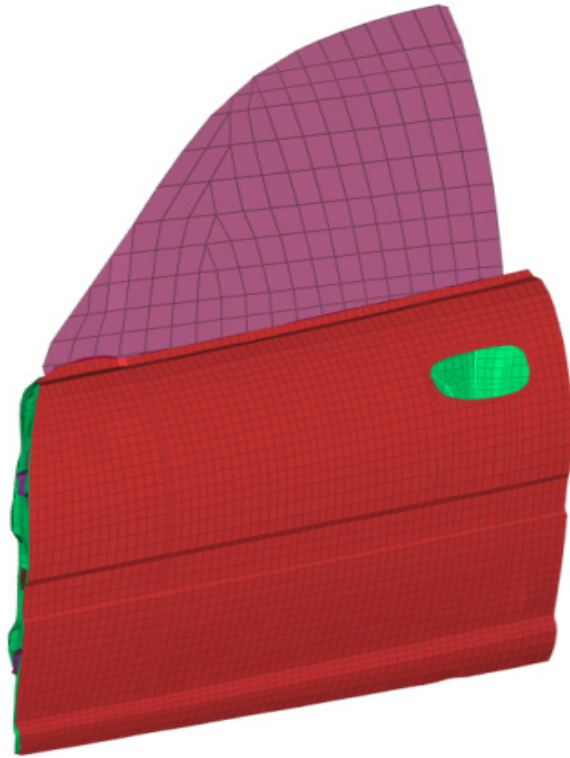
# Problem Definition



## Common model

- Process in sequence
- Separate processes

# Common Model



## Full Door Model

- Elements
- Nodes
- Assembly entities
  - Rigids
  - Constraints
  - Contacts
- Properties
- Materials

# Convert entities

NASTRAN

Name	Number	Visible
Analysis Parameters		
> B.C. SET	1	
FE Structure		
GRID	11658	
ELEMENT	10991	10991
RBE2	4	4
> SHELL	10987	10987
> PROPERTY	13	
PSHELL	13	
> MATERIAL	1	
MAT1	1	
FE Auxiliaries		
SET	22	
INCLUDE	8	
CONTACT	1	1
BCBODY	1	0
Assembly		
> CONNECTION	390	390
MB Containers		
ANSAPART	14	
ANSA Auxiliaries		
WPLANE	3	3
EDGE		

PAMCRASH

Name	Number	Visible
Analysis Parameters		
> CONTROL	1	
FE Structure		
NODE	11658	
ELEMENT	11182	11182
PLINK	195	195
> SHELL	10987	10987
> CONSTRAINTS	5	5
CNTAC	1	1
RBODY	4	4
> PROPERTY	17	
PART_PLINK	4	
PART_SHELL	13	
> MATERIAL	2	
PAM LINK Material 302	1	
PAM SHELL Material 103	1	
FE Auxiliaries		
GROUP	22	
INCLUDE	8	
> FUNCTIONS	5	
Assembly		
> CONNECTION	390	390
MB Containers		
ANSAPART	14	
ANSA Auxiliaries		
WPLANE	3	3
EDGE		

LSDYNA

Name	Number	Visible
FE Structure		
NODE	11658	
ELEMENT	10987	10987
> ELEMENT_SHELL	10987	10987
QUAD	10331	10331
TRIA	656	656
> CONSTRAINED	4	4
CONSTRAINED_NODAL_RIGID_BODY	4	4
> PROPERTY	13	
SECTION_SHELL	13	
> MATERIAL	1	
MAT1 MAT_ELASTIC	1	
FE Auxiliaries		
SET	22	
INCLUDE	8	
CONTACT	1	1
> DEFINE	5	
DEFINE_CURVE	5	
Assembly		
> CONNECTION	390	390
MB Containers		
ANSAPART	14	
ANSA Auxiliaries		
WPLANE	3	3
EDGE		

## Entities

- Common
  - Nodes
  - Elements
- All formats
  - RBE2
- Solver specific
  - PLINK

## Support entities

- VMAP\_RBE\_<type>
    - <xo, yo, zo>
    - 1200
    - 100238 – 110956
- OR
- [10, 11, 12 ...]

#{position}

#{property id}

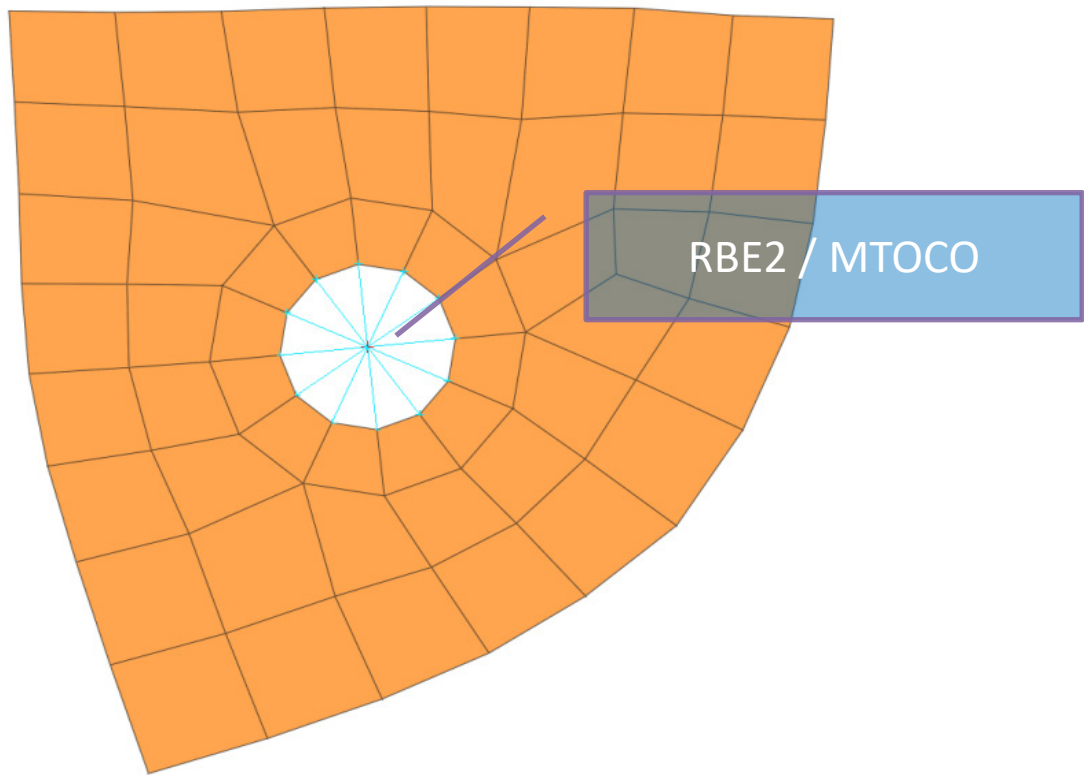
#{connectivity}

#{node ids}

## Common Entities

- VMAP\_RBE
- Solver translation
  - RBE2/RBE3 in NASTRAN
  - MTOCO/OTMCO in PAM

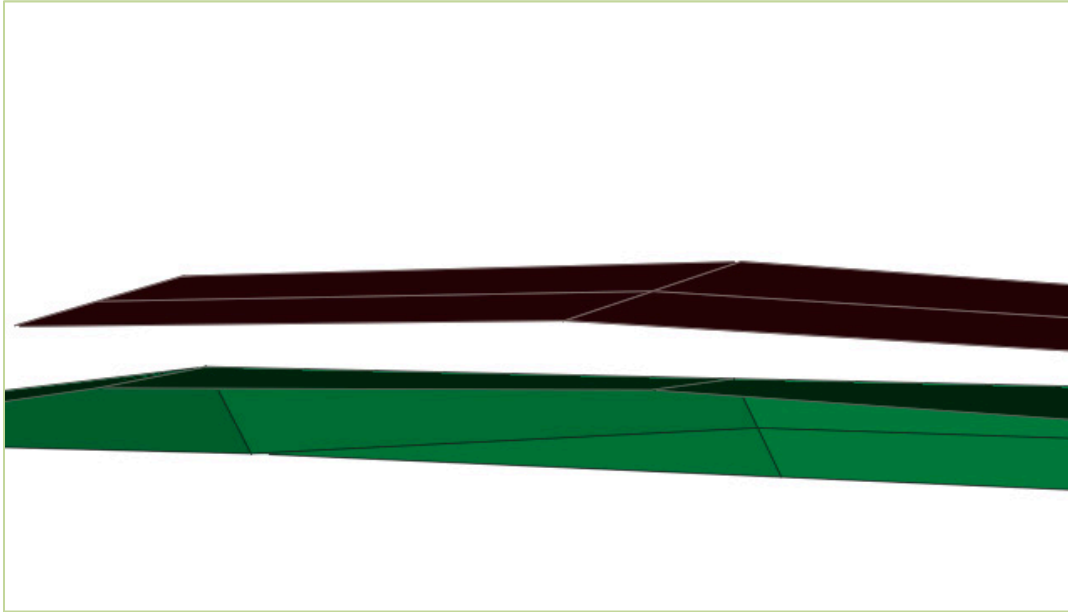
# Support entities



## Common Entities

- VMAP\_RBE
- Solver translation
  - RBE2 in NASTRAN
  - MTOCO in PAM

## Support entities



## Missing Entities

- VMAP entity
- Neutral entity



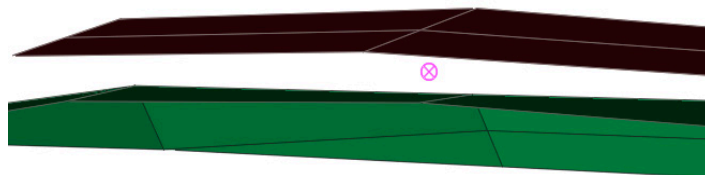
## Support entities

- VMAP\_CNCT
  - <x0, y0, z0>                   #{position}
  - 100238 – 110956               #{connectivity}
  - 1200                            #{property id}
  - NASTRAN                       #{solver}
  - CWELD                        #{FE-entity}
  - PAMCRASH                    #{solver}
  - PLINK                        #{FE-entity}
  - ...

## VMAP entity format

- **VMAP\_CNCT**
  - minimum required information
    - Connectivity
    - Position
    - Property
    - Solver entity
  - Solver must 'translate' the entity

# Support entities



```
<?xml version="1.0" encoding="UTF-8"?>
<xml_connection_file xmlns:xsi="http://www.w3.org/2000/10/XMLSchema-inst
<version> 1.0.0 </version>
<connection_group>
  <id> 1 </id>
  <connected_to>
    <pid> 1514 </pid>
    <pid> 1512 </pid>
  </connected_to>
  <connection_list>
    <connection_0d>
      <id> 100004 </id>
      <type>spotweld</type>
      <loc> -2917.23 -747.52 881.929 </loc>
      <info> dia 5. </info>
      <info> user_attribute Connectivity_Inspection/Approval Needs Chec
    </connection_0d>
  </connection_list>
</connection_group>
```

## Define a neutral entity

### ○ **Generic CNCT**

- Neutral format
- Information
  - Connectivity
  - Position
  - Property
  - Solver Entity

- Solver creates the needed entity

# Convert Materials

The screenshot displays two overlapping dialog boxes in a software application. The top dialog, titled 'PAM SHELL Material 101 [PAM SHELL Material 101]', has a 'Name' field containing 'Material Steel'. It features two tabs: 'Main' and 'Misc'. The 'Main' tab contains a table of material properties:

IDMAT	MATYP	r	NINT	ISHG	ISTRAT	IFROZ
103	+	7.85E-9	0	0	0	

Below this table are fields for AVP1 through AVP6, QVM, TDN, and IDMPD. The bottom dialog, titled 'MAT1 MAT\_ELASTIC [MAT1 MAT\_ELASTIC]', also has a 'Name' field with 'Material Steel'. It has 'Main' and 'Misc' tabs. The 'Main' tab contains a table of material properties:

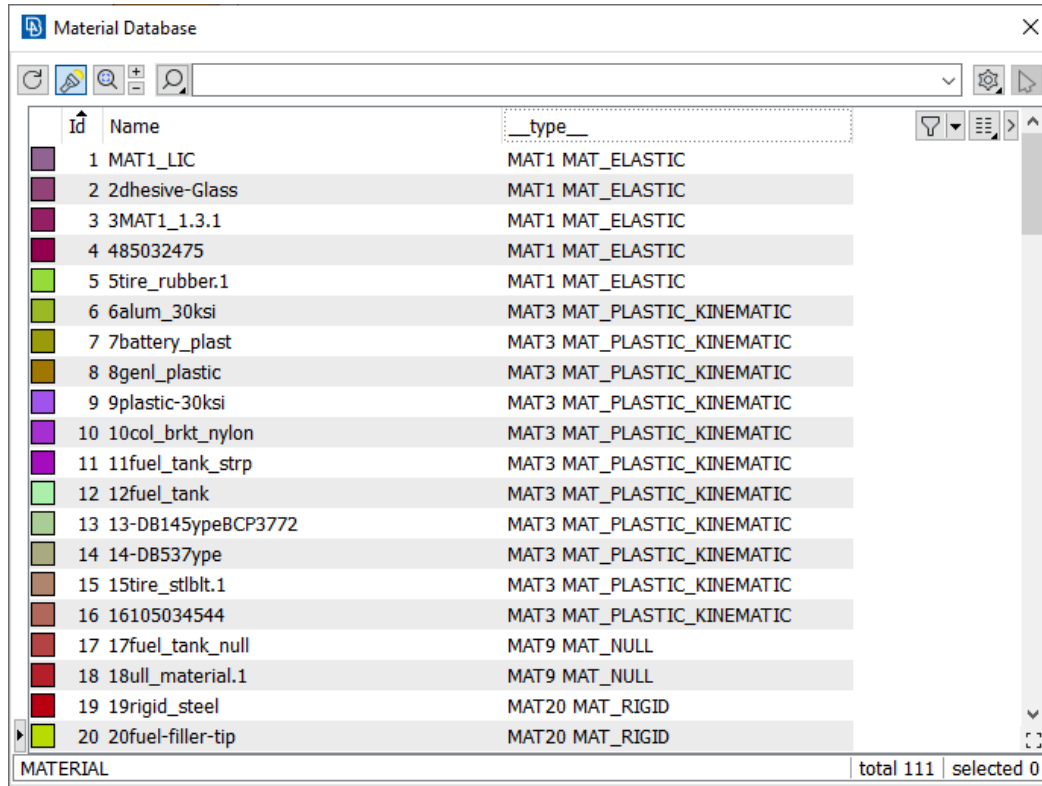
MID	RO	E	PR	DA	DB	K
1041	7.859E-6	210.	0.3	0	0	0

Below this table is a section labeled '\*MAT\_ADD\_EROSION' with an empty input field. Both dialog boxes have 'OK' and 'Cancel' buttons at the bottom.

## Material Cards

- Different models
- Different definitions

# Convert Materials – Material DB



The screenshot shows a window titled "Material Database" with a search bar and a list of materials. The list has three columns: "Id", "Name", and "\_\_type\_\_". The materials are listed as follows:

Id	Name	__type__
1	MAT1_LIC	MAT1 MAT_ELASTIC
2	2dhesive-Glass	MAT1 MAT_ELASTIC
3	3MAT1_1.3.1	MAT1 MAT_ELASTIC
4	485032475	MAT1 MAT_ELASTIC
5	5tire_rubber.1	MAT1 MAT_ELASTIC
6	6alum_30ksi	MAT3 MAT_PLASTIC_KINEMATIC
7	7battery_plast	MAT3 MAT_PLASTIC_KINEMATIC
8	8genl_plastic	MAT3 MAT_PLASTIC_KINEMATIC
9	9plastic-30ksi	MAT3 MAT_PLASTIC_KINEMATIC
10	10col_brkt_nylon	MAT3 MAT_PLASTIC_KINEMATIC
11	11fuel_tank_strp	MAT3 MAT_PLASTIC_KINEMATIC
12	12fuel_tank	MAT3 MAT_PLASTIC_KINEMATIC
13	13-DB145ypeBCP3772	MAT3 MAT_PLASTIC_KINEMATIC
14	14-DB537ype	MAT3 MAT_PLASTIC_KINEMATIC
15	15tire_stlblt.1	MAT3 MAT_PLASTIC_KINEMATIC
16	16105034544	MAT3 MAT_PLASTIC_KINEMATIC
17	17fuel_tank_null	MAT9 MAT_NULL
18	18ull_material.1	MAT9 MAT_NULL
19	19rigid_steel	MAT20 MAT_RIGID
20	20fuel-filler-tip	MAT20 MAT_RIGID

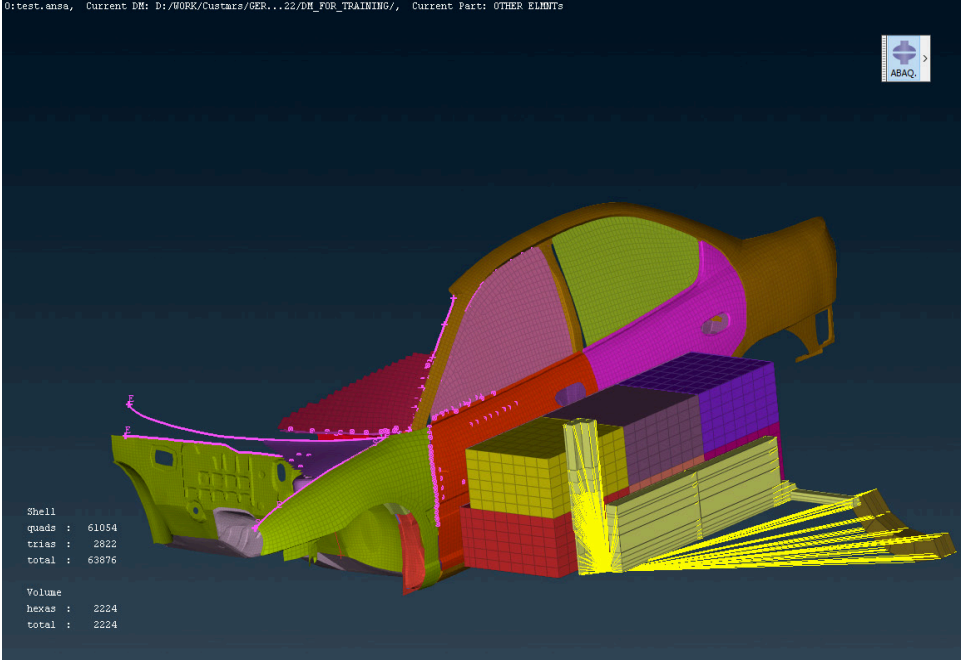
At the bottom of the window, it says "MATERIAL" and "total 111 | selected 0".

## Material Database

- Model definition by Id or name
- Solver updates material information

# Working in ANSA

Ortest.ans, Current DM: D:\WORK\Custars\GER...22\DM\_FOR\_TRAINING/, Current Part: OTHER ELMINTS



Shell  
quads : 61054  
trias : 2822  
total : 63876

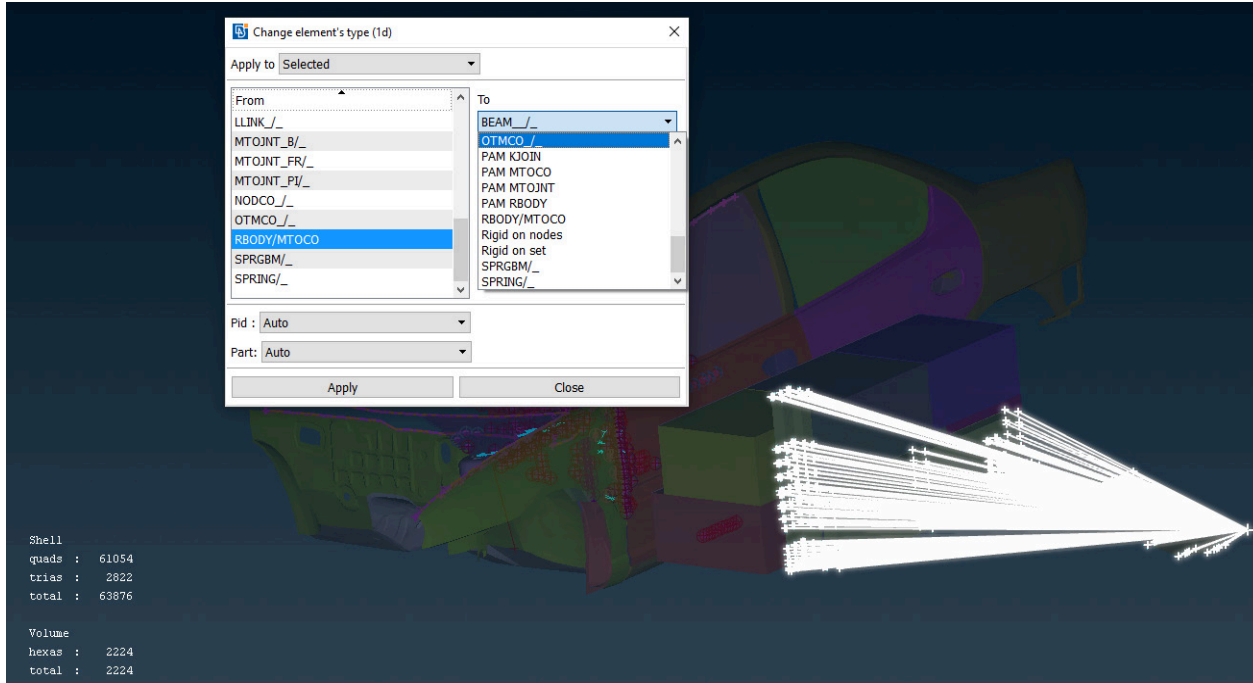
Volume  
hexas : 2224  
total : 2224

Database			
Database		Includes	Sets
Name	Number	Visible	
<input checked="" type="checkbox"/> FE Structure	77102		
> COORD	1	1	
<input checked="" type="checkbox"/> ELEMENT	66101	66101	
> SHELL	63876	63876	
> SOLID	2224	2224	
<input checked="" type="checkbox"/> TRUSS	1	1	
> CONSTRAINT	16	16	
> PROPERTY	65		
MATERIAL	10		
<input type="checkbox"/> FE Auxiliaries			
SET	109		
INCLUDE	8		
<input type="checkbox"/> CONTACT	1	0	
> DEPENDENCY	7		
NMAP	1		
<input checked="" type="checkbox"/> Assembly			
> CONNECTION	266	266	
<input checked="" type="checkbox"/> ANSA Auxiliaries			
ANSAPART	78		
<input type="checkbox"/> WPLANE	3	0	
EDGE			
SOLIDFACET			

## Interoperability

- Model set-up for any solver
- Interoperability among different solvers

# Working in ANSA



## Convert entities

- Hard-coded
- Soft-coded

# Working in ANSA

Connectivity Check GraphView

Checks Manager (C:/Users/tfassas/AppData/Local/Apps/BETA\_CAE\_Systems/ansa\_v23.1.0/c...

Connections

Type	Message Code	Entity	ID	Description
Error	E3875	SpotweldPoint_Type	100087	Connection failed to project on p...
Error	E3875	SpotweldPoint_Type	100107	Connection failed to project on p...
Error	E3875	SpotweldPoint_Type	100109	Connection failed to project on p...

total 3 | selected 0

Name

- Check number of parts < 2
- Check projections success
- Check maximum distance
- Check minimum distance
- Check flanges angle
- Check projections proximity
- Check total thickness
- Check double connections
- Check spider positioning
- Check intersecting parts
- Check connections outside flange
- Check partial cnctn line realization
- Check sufficient nodes near connection

Connections are checked with regard to feature angle, proximities, etc

**Python Example**

```
import ansa
obj = ansa.base.checks.general.Connections()
obj.execute()

# examples of setting options
#
#obj.check_num_of_parts = False
#obj.projection_tolerance = 10.0
#obj.check_max_distance = False
#obj.max_distance_method = "By av
#obj.max_average_thickness_factor
#obj.max_absolute_distance = 10.0
#obj.check_min_distance = False
#obj.min_distance_method = "By av
#obj.min_average_thickness_factor
#obj.min_absolute_distance = 5.0
#obj.check_flanges_angle = False
#obj.max_allowed_angle = 20.0
```

total 12 | selected 0

components: 9, connector groups: 3

Shell

- quads : 15506
- trias : 921
- total : 16427
- Unchecked : 1

Volume

- hexas : 223
- total : 223

## Connection Entities

- All connectivity formats
- Integrity checks

# Working in ANSA

The screenshot displays two windows from the ANSA software. The top-left window is titled 'Materials' and contains a table with the following data:

Id	Name	E	r	__type__
100	FR_100-Elastic plastic	230000.	7850.	PAM SHELL Material 102
200	MD-200-Elastic plastic	240000.	7850.	PAM SHELL Material 102
300	RR_300-Elastic plastic	180000.	7850.	PAM SHELL Material 102

The bottom-left window is also titled 'Materials' and shows a similar table, but with updated values for E and r:

Id	Name	E	r	__type__
100	FR_100-Elastic plastic mat102	210.	7.85E-6	PAM SHELL Material 102
200	MD-200-Elastic plastic mat102	210.	7.85E-6	PAM SHELL Material 102
300	RR_300-Elastic plastic mat102	210.	7.85E-6	PAM SHELL Material 102

The top-right window is titled 'Material Database' and shows a table with the following data:

Id	Name	E	r
100	FR_100-Elastic plastic mat102	210.	7.85E-6
200	MD-200-Elastic plastic mat102	210.	7.85E-6
300	RR_300-Elastic plastic mat102	210.	7.85E-6

Below the table in the 'Material Database' window is a context menu with the following options:

- Update by IDs
- Update by NAMES
- Copy


























## Material Update

- Solver updates material information



# VMAP format in ANSA



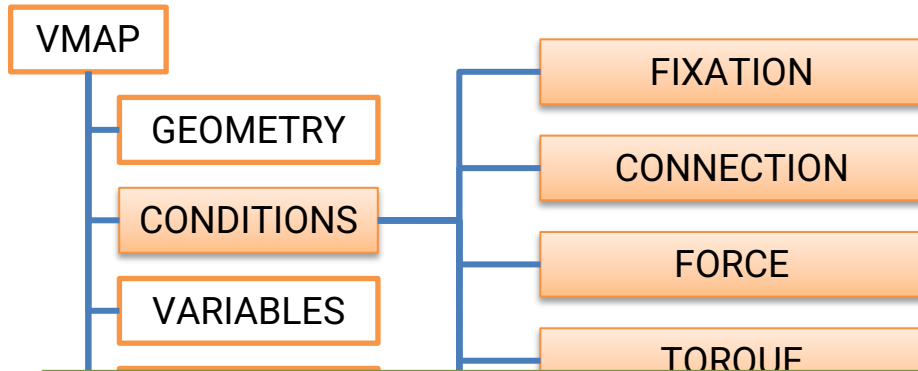
	NASTRAN
	LS-DYNA
	PAM-CRASH
	ABAQUS
	RADIOSS
	ANSYS
	PERMAS
	OPTISTRUC
	MARC
	ACTRAN
	IMPETUS
	MOLDEX3D
	SESTRA
	CFD++
	FLUENT
	FLUENT-2D
	OPENFOAM
	STAR
	UH3D
	SC/TETRA
	TAITHERM
	THESEUS
	TAU
	CGNS
	CGNS-2D



## ANSYS for VMAP

- Start with:
  - VMAP file
  - Solver format
- Work in any solver definition
- Output VMAP format

# Suggestion for VMAP extension: CONDITIONS group → Boundary Conditions + Loads



**“VMAP-enabled multi-disciplinary collaboration on jet engine design”**

Presentation:

„VMAP-enabled multi-disciplinary collaboration on jet engine design”

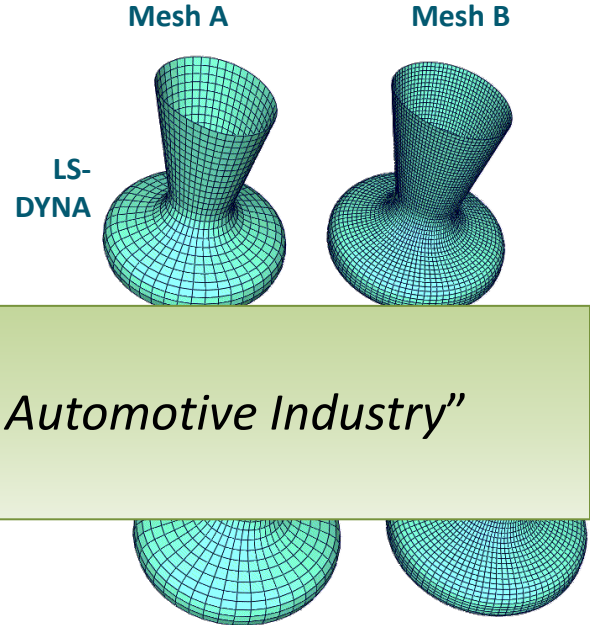
Thursday 15 Feb 08:05



Photo by  
Chaitanya Pillala  
on Unsplash

# SMILE

## UNIFIED SIMULATION MODELLING LANGUAGE



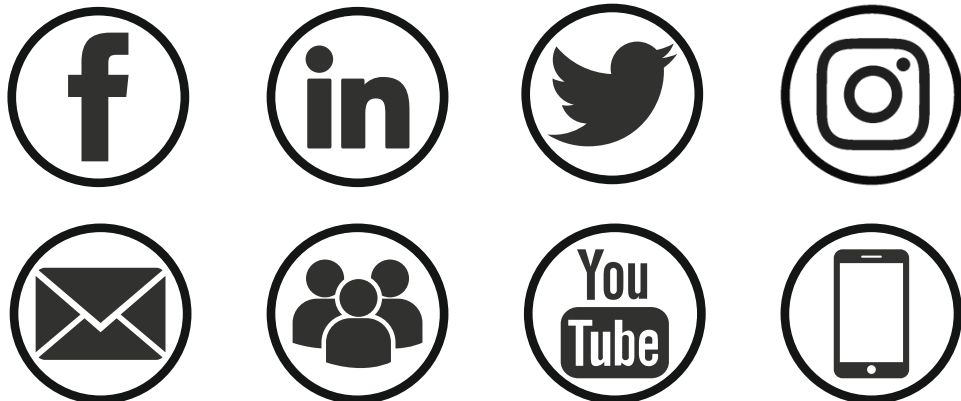
- Solver independent

Presentation:

*„Standardized Simulation Workflows in the Automotive Industry“*

Thursday 15 Feb 09:20

- Supports democratization of simulation
- Support multiple discretizations



**Stay connected**